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24.10.85-JP-236389 *(06.05.87)* C08k-07 C08l-101
Metal-like moulded resin prod. - comprises resin and lustrous particles occupying specified area of surface
C87-068852

A(8-E1, 11-A1A, 11-B1)

Moulded resin prod. comprises a resin and lustred particles. Average dia. of the particles is 20-500 microns, and the area occupied by the particles on the surface of the resin prod. is 0.5-16.0% of the total surface area.

Resin is acrylic, PS, PP, PVC, ABS, etc. Various colours can be applied in amt. 0.1-12 vol.% of 100 pts. resin. Injection moulding or injection-compression moulding is esp. effective. Lustred particles are of Al, Sn, Cu, Fe, brass, etc.

USE/ADVANTAGE - For interior and exterior parts and containers for cameras, VTR's, electric razors, and cosmetics, etc. Prod. eliminates weld-marks and has brilliant metallic-like look. The effect is conspicuous when dyed thermoplastic resin is used. (4pp Dwg.No.0/5)

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(54) Title of the invention: Resin moulded articles

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Specification

1. Title of the Invention

Resin moulded articles

2. Scope of Claim

Resin moulded articles which are characterized in that, in resin moulded articles containing resin plus lustrous particles, the mean equivalent diameter of the said lustrous particles is 20-500 μm and, furthermore, when viewed from the surface of the resin moulded article the occupancy area of these lustrous particles is from 0.5 to 16.0% of the total surface area.

3. Detailed Description of the Invention

[Industrial Field of Application]

The present invention relates to resin moulded articles which are used for cameras, VTRs, OA equipment, electric razors, interior and exterior decorative materials for cosmetic products, containers and the like.

[Prior-Art]

There are many known examples of moulded articles produced by mixing together and then melting and moulding a thermoplastic resin and a filler material such as metal particles for conferring a lustrous external appearance. Depending on the shape of the lustre-conferring particles, these moulded articles fall into two categories. The first, as disclosed in JP-A-58-37045, comprises moulded articles where the entire surface is given a uniform metal-like appearance, that

is to say a metallic tone, by filling the resin with fine or superfine metal particles. When such moulded articles are produced by injection moulding, as can be seen in the flow sections of the molten resin within the mould illustrated in Figure 2 and Figure 3, a layer **2** which does not contain metal particles is formed at the front of the flow during the flow process (Figure 2) so that a weld mark **3** (Figure 3) comprising resin alone is formed at the weld between the two melt flows. Since this weld mark does not contain metal particles, light is absorbed and it looks black, so the appearance is markedly impaired. Consequently, such a moulded article cannot be used as a camera outer cover or other such high grade moulded article.

The second category comprises the use of a metal flake powder having a mean equivalent diameter of at least 30 μm and a mean shape factor of 1/10 or less. With such moulded articles, at the time of the kneading and moulding of the resin and metal flake powder, the flake powder is subjected to shear and breaks up. If there is no such break-up, the weld mark in the moulded article becomes inconspicuous but if break-up does occur then this results in a conspicuous weld mark just as is seen in the first category described above.

Now, Figure 4 and Figure 5 show the particle size distributions before and after the kneading and moulding of an aluminium flake powder of mean equivalent diameter 50 μm and mean shape factor 1/10 or less. In this case, the weld mark becomes conspicuous and use as a high grade moulded article of complex shape is difficult.

[Objective and Features of the Invention]

A first objective of the present invention lies in offering resin moulded articles which are free of the defects in appearance caused by the weld marks, etc, seen in conventional resin moulded articles filled with lustre-conferring particles.

A second objective of the present invention lies in offering resin moulded articles which, as well as being free of such surface defects, have an outstanding appearance, namely a glittering appearance like stars scattered in the clear night sky (below this is referred to as a star-like[i] appearance), enabling them to be used for complex-shaped high grade moulded articles such as camera outer covers, VTR covers and the like.

The aforesaid objectives are realized by means of the resin moulded articles of the present invention which are characterized in that, in resin moulded articles containing resin plus lustrous particles, the mean equivalent diameter of said lustrous particles is 20-500 μm and, furthermore, when viewed from the surface of the resin moulded article the occupancy area of these lustrous particles is from 0.5 to 16.0% of the total surface area.

[Detailed Explanation of the Invention and Examples thereof]

The aforesaid lustrous particles which are used in the present invention are particles with a mean equivalent diameter of 20 to 500 μm.

Taking the arithmetic mean of the maximum diameter and the minimum diameter of a lustrous particle as its

equivalent diameter, the mean equivalent diameter refers to the value obtained by averaging the equivalent diameters for a group of test particles. The measurement of the equivalent diameter can be carried out using a Luzex particle distribution measurement device (commercial product name; produced by Nippon Regulator K.K. [Nireco]), with the moulded article placed on a glass plate either in the as-moulded state or after dissolving in solvent.

If the mean equivalent diameter of the lustrous particles is less than 20 μm, it becomes difficult to distinguish each individual lustrous particle by eye, so in trying to obtain a metallic appearance the occupancy area of the lustrous particles inevitably becomes too great and there is a conspicuous weld mark. If the figure exceeds 500 μm, the individual particles are too conspicuous and the sense of high quality is impaired. The mean equivalent diameter is more preferably 30 to 250 μm.

The occupancy area of the lustrous particles seen from the surface of the resin moulded articles can be measured for example by suspending the moulded article in the aforesaid Luzex and distinguishing between lustrous particles and resin in the vicinity of the moulded article surface.

Generally speaking, the occupancy area of the lustrous particles is governed to a considerable extent by the light transmittance of the moulded article.

For example, in the case where colourless polycarbonate resin is filled with aluminium particles, since all the

particles will be visible from the moulded article surface, the occupancy area often exceeds 80%.

However, if the polycarbonate resin is coloured with carbon black, the visibility from the surface is limited to the region 10-200 μm from the surface layer.

If the lustrous particles are assumed to be spherical, in a system in which the spheres are distributed in such a way that the distance between the centres of the spheres is the same, the average space between the lustrous particles is expressed by formula (1).

$$D = R \left(\sqrt[3]{\frac{\pi}{3\sqrt{2}\,V}} - 1 \right) \qquad (1)$$

D: average space between lustrous particles
R: mean equivalent diameter of the lustrous particles
V: volume ratio of all the lustrous particles in terms of the total volume of thermoplastic resin and lustrous particles

When the transmission range of the light is D, then theoretically the occupancy area is

$$\frac{\pi R^2}{\left(\frac{\pi}{2} + \sqrt{3}\right)(D + R)^2}$$

In the case of a normal coloured resin, the light transmission range is roughly 10-300 μm, so providing the occupancy area is no more than 16.0% weld marks are not conspicuous. Furthermore, if the occupancy area is less than 0.5%, then the effects of incorporating the lustrous particles are hard to distinguish by eye.

Consequently, the range 0.5 to 16.0% is desirable, and the range 2.0-10.0% is preferred.

It is possible to suitably determine the content of the lustrous particles in the resin moulded article so as to obtain this occupancy area of lustrous particles and, normally, selection is made from within the range 0.1 to 5.0 parts by volume per 100 parts by volume of the resin.

Furthermore, the shape of the lustrous particles can be freely selected but a mean shape factor in the range 1/8 to 1 is preferred. Here, the mean shape factor refers to the arithmetic mean of the ratios of the maximum to the minimum diameters of the particles, that is to say (minimum diameter)/(maximum diameter). In calculating the mean shape factor, there can again be used the Luzex particle distribution measurement device. If the mean shape factor is less[ii] than 1/8, then at the time of kneading and moulding, break-up of the lustrous particles will readily take place and weld marks will tend to be conspicuous. It is particularly preferred that the mean shape factor be 1/3 to 1.

Any material can be used for the lustrous particles employed in the present invention, providing that they are particles possessing lustre at the surface. For example, it is possible to use lustrous particles at least the surface layer region of which comprises a metal such as aluminium, tin, copper or iron, alloys based on such metals like brass or stainless steel, and mica, various types of shell, inorganic or organic polymer crystals of the kind which bring about birefringence, phosphors or the like.

When, for example, aluminium particles are used, there is obtained a glittering silver appearance, while when brass particles are used there is obtained a soft golden appearance. Again, it is possible to form a variety of appearances by changing the surface lustre of the metal particles.

The resin employed in the present invention is for example a thermoplastic resin such as an acrylic resin, polystyrene resin, polypropylene resin or other such polyolefin resin, vinyl chloride resin, methyl pentene resin, polycarbonate resin, copolyester, copolyamide, ABS or the like, or mixtures of these, and it may also be coloured. Alternatively, there may be used an elastomer. Furthermore, it is also possible to form a still greater variety of appearances by mixing colouring agent into the resin moulded article of the present invention, for example 0.1 to 12.0 parts by volume thereof per 100 parts by volume of the resin.

Again, it is also possible to add the various stabilizers, mould release agents, antistatic agents, flame retardants and the like which may be incorporated into thermoplastic resins, providing the amount lies within a range such that the effects of the invention are not impaired.

In the case where the resin moulded articles of the present invention are produced by injection moulding or injection compression moulding, the effects of the invention are particularly manifested but there may also be used other types of molten moulding methods such as extrusion.

Silver streaks, which are another type of defect in appearance, have long been said to occur readily in moulding to provide a metallic appearance but by making the drying time at least 2 hours and ensuring that the mould temperature does not drop, there is no occurrence of silver streaks in the case of the star-like appearance. Furthermore, in the case of a metallic tone, a pinpoint moulding gate increases the occurrence of silver streaks but, with the star-like appearance of the present invention, silver streaks do not occur even with a pinpoint gate.

In terms of uniformly dispersing the lustrous particles in the moulded article, the thermoplastic resin and lustrous particles are preferably used in the form of a composition such as, for example, pellets obtained by prior melting and mixing of the resin.

Below, the present invention is explained in still more specific terms by means of examples.

Example 1

Using a resin material comprising 100 parts by volume of polycarbonate containing colouring agent (carbon black, etc) and 1 part by volume of aluminium particles (mean equivalent diameter 43 μm), the camera front cover shown in Figure 1 was moulded.

moulding conditions:

cylinder temperature = 295, 290, 285, 230°C

injection pressure = 1450 kg/cm^2

mould temperature = 120-125°C

The occupancy area of the aluminium particles in the surface of the resin moulded article obtained was 6.2% of the total surface area. This moulded article had no defects in terms of appearance such as weld marks and a high grade metallic appearance was shown.

Examples 2 and 3

Moulded articles were obtained in the same way as in Example 1 except that the mean equivalent diameter of the aluminium particles used was changed to 80 μm or to 210 μm. In each case, the moulded article had no weld marks just like in Example 1, and a high grade metallic appearance was shown.

Examples 4 and 5

Moulded articles were obtained in the same way as in Example 1 except that the aluminium particle content was adjusted so that the occupancy area seen from the surface of the moulded article was changed to 1.2% or to 14.5%. In each case, the moulded article obtained had no weld marks just like in Example 1, and a high grade metallic appearance was shown.

Comparative Example 1

A moulded article was obtained in the same way as in Example 1 except that there was used a material comprising 100 parts by volume of polycarbonate resin containing colouring agent (carbon black, etc) and 6 parts by volume of aluminium particles (mean equivalent diameter 2.4 μm).

The occupancy area of the aluminium particles was 100%, and the weld, etc, was conspicuous, so this could not be used as a moulded article of high grade appearance.

[Effects of the Invention]

The resin moulded articles of the present invention are free of weld marks and, in terms of appearance, provide a 'subdued tone' which can be used for high grade moulded articles like camera outer covers and the outer covers of OA equipment, etc, which has not been achievable hitherto. Thus, it is possible to broaden the design framework in terms of plastics appearance. In particular, in the case where thermoplastic resins which have been coloured by a colouring agent are employed, the effects of the invention are remarkable and the invention may also be applied to articles of complex shape.

4. Brief Explanation of the Drawings

Figure 1(a) to (d) are a plan view, front view, left side section and right side section of a camera outer cover based on the present invention.

Figure 2 is a sectional view of the flow of a conventional metal-filled resin; Figure 3 is a sectional view after moulding of the metal-filled resin; Figure 4 and Figure 5 are graphs showing the particle size distribution (frequency distribution) before and after moulding in the case where lustrous particles of mean shape factor 1/10 or less are used.

1 ... metal powder
2 ... layer of resin alone

3 ... weld mark

Agent Patent Attorney J. Yamashita

Figure 1

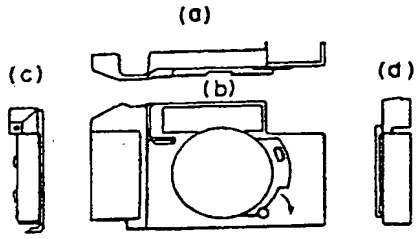


Figure 2

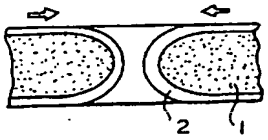


Figure 3

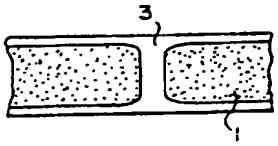


Figure 4

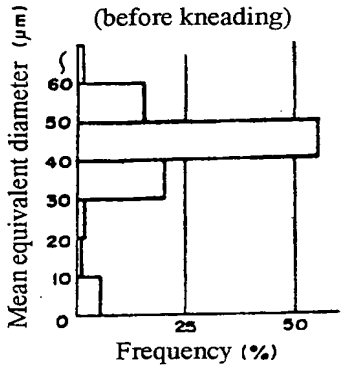
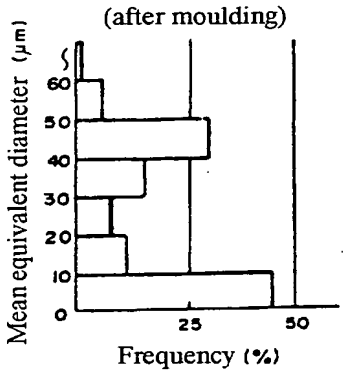


Figure 5


(after moulding)
Mean equivalent diameter (μm)
60
50
40
30
20
10
0
25
50
Frequency (%)

Translator's Notes

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[i] The Japanese term 'ginga' translates as "milky way" or "a galaxy". The meaning here would seem to suggest numerous glittering star-like points of light.

[ii] Presumably what is meant is "If the shape factor is 1/>8, then …"